DOCUMENT RESUME

ED 446 961 SE 064 181

AUTHOR Farbrother, Barry J.
TITLE Rose-Hulman Institute of Technology's Technology & Entrepreneurial Development Program.
PUB DATE 1998-08-00
NOTE 5p.; Paper presented at the International Conference on Engineering Education (Rio de Janeiro, Brazil, August 17-20, 1998).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Economics; Engineering Education; Higher Education; *Industry; Internship Programs; *Partnerships in Education; *School Business Relationship; Science Education; *Technology

ABSTRACT

The era of economic dominance supported by the existence of a large and inexpensive labor pool, and expanding domestic market, and/or exploitation of natural resources is over in the United States. It's time to work smarter, not just work harder. Thus, the economic vitality of any region in a modern economy is dependent on the ability of its institutions to harness innovation and knowledge in order to create wealth for the population of that region. Colleges and universities, while they are one of the major repositories of intellectual capital, have traditionally stayed at "arms length" from the commercial activities of the companies that hire their graduates. It is probably appropriate that there be significant differences in the operating premises and mission philosophies of the two types of organizations. However, corporations and colleges share a mutual interest in the economy. If the future success of the economy is based upon innovation and knowledge, it seems an opportune time for these two types of organizations to become colleagues in an economic partnership that brings together the resources and needs of each for the betterment of both. The general mechanism of the economic partnership between Rose-Hulman Institute of Technology and the corporate sector in Indiana is through Rose-Hulman's Technology and Entrepreneurial Development Program (TED). Business, industry, and government benefit from the creativity, innovation, and technical competence offered by the college community. Faculty and students benefit from the opportunity to work within real world constraints on customer-driven problems. (Author)

Reproductions supplied by EDRS are the best that can be made
from the original document.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

B Farbrother

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

1

Rose-Hulman Institute of Technology's Technology & Entrepreneurial Development Program

Barry J. Farbrother Ph.D., C.Eng.
Interim Vice-President for Academic Affairs & Dean of the Faculty,
Professor of Electrical & Computer Engineering,
Rose-Hulman Institute of Technology,
Terre Haute,Indiana 47803-3999
USA

ED 446 961

Abstract *- The era of economic dominance supported by the existence of a large and inexpensive labor pool, an expanding domestic market, and/or exploitation of natural resources is over in the United States. It's time to work smarter, not just work harder. Thus, the economic vitality of any region in a modern economy is dependent on the ability of its institutions to harness innovation and knowledge in order to create wealth for the population of that region. Colleges and universities, while they are one of the major repositories of intellectual capital, have traditionally stayed at "arms length" from the commercial activities of the companies that hire their graduates. It is probably appropriate that there be significant differences in the operating premises and mission philosophies of the two types of organizations. However, corporations and colleges share a mutual interest in the economy. If the future success of the economy is based upon innovation and knowledge, it seems an opportune time for these two types of organizations to become colleagues in an economic partnership that brings together the resources and needs of each for the betterment of both.*

The general mechanism of the economic partnership between Rose-Hulman Institute of Technology and the corporate sector in Indiana is through Rose-Hulman's Technology and Entrepreneurial Development Program[1] (TED). Business, industry, and government benefit from the creativity, innovation, and technical competence offered by the college community. Faculty and students benefit from the opportunity to work within real world constraints on customer-driven problems.

Introduction

There are several challenges currently facing the traditional four year college the most prominent of which is cost, although the virtual university is an emerging competitor. Recently there have been several reports in the media that address the issue of rising costs in higher education and some go even further to forecast the impending doom of the traditional university.[2] Engineering and science degrees have always been more expensive than degrees in the arts for example, because the costs associated with engineering programs are higher. Another factor is the decreasing support that universities are receiving from their legislatures, alumni or other supporters. Industry has never been a customer (in the truest sense of the word) of the educational institution although it may justifiably be regarded as its most important constituency. However, in an era when the parents of potential students are looking carefully at the high cost of tertiary education, it is incumbent upon us to look at our costs and attempt to contain them. We must examine everything we do and how we do it. That is, we must employ a total quality improvement philosophy, so that we contain costs at the same time as we improve quality.

Another important development that has to be factored into the current situation is the rapid growth of the virtual institution as exemplified by the Western Governor's University, University of Phoenix, and others.[3],[4] Traditional educational institutions must look at new paradigms for their operations in order to clearly demonstrate the benefits of their programs over these less-traditional, newly-emerging players in the educational marketplace[5]. Perhaps these will incorporate some aspects of the virtual academy, yet continue to allow institutions to offer the rigorous educational experience for which they have become well regarded.

One way of containing costs and demonstrating the value added nature of more traditional educational programs is through partnerships with industry. This paper describes a program at Rose-Hulman Institute of Technology that provides opportunities for students and faculty to work with industrial clients, and simultaneously contribute to the economic health of the region. Our increasingly knowledge-intensive economy makes ideas even more crucial to business success. For businesses to stay competitive, our challenge is not only to technically educate our students, but also to equip them with the entrepreneurial skills to translate ideas into successful products and companies. Creation of successful small businesses will also make a significant impact on the economic health of any region.

SECO41681

BEST COPY AVAILABLE

Industrial partners, particularly the smaller entrepreneurial ones, can benefit considerably through access to the intellectual resources of the institution. Another focus of such relationships is to make it possible for students contemplating entrepreneurial careers to learn first hand what it is like to work in an entrepreneurial company. The net result of such initiatives is that the educational institution gains access to potentially commercial projects; organizations gain access to intellectual resources, and significant networking infrastructure is established. In the long term this latter feature may emerge to be the most significant contribution the educational institution can make towards enhancing the economic vitality of a region. By establishing links between students and companies it is possible to develop areas for faculty/industry collaboration and promote employment opportunities for graduate engineers. This in turn has the potential to improve the retention of graduates within the region.

The Technology & Entrepreneurial Development Program (TED)

Rose-Hulman has been involved in joint projects with industry for several years. The funding provided for the T.E.D. program has made it possible to make a marked increase in the number and sophistication of these projects and, in the long term, will permit us to put in place a support system that will maintain this enhanced level of activity. From the educational perspective, our desire is to show students how to acquire the knowledge they need to use technology to contribute to society and their own economic well being. Only time will tell if they really do learn how to learn. Project experience at Rose-Hulman will surely help them early in their careers, but the key to their futures is their ability to do it again and again for themselves as technology changes.

I will discuss the various program segments as distinguishable parts but it must be kept in mind that the expected outcomes result from the combination of all of the segments of the program, i.e. the projects, the laboratories, and the relationships established through the internships and co-op programs. All are closely related, mutually supportive, and essential to the realization of the desired outcomes.

The program was initiated in 1996 with the support of the Lilly Endowment Inc.[1] Project funds support the activities of faculty, students and T.E.D. personnel but not capital equipment. Subsequent to the award of T.E.D. funds, Rose-Hulman secured additional funding for a 40,000 square foot building - the Center for Technological Research with Industry (C.T.R.I.) which will incorporate office space, product and process development laboratories and additional general purpose laboratories. The institution is currently seeking additional funds for the computers, laboratory equipment and other capital equipment items that will complete the facility.

Technical personnel required for a project of this magnitude include:

Director: to formulate the strategic plan for the T.E.D. program, insure that it is implemented and to oversee day-to-day operations.

Marketing Engineer: to promote the T.E.D. program and identify suitable projects from corporations within Indiana.

Project Engineers: to provide technical expertise and continuity for project work.

Facility Manager: to oversee the day-to-day operation of the C.T.R.I. facility, including the scheduling of laboratory space, computers and equipment.

Secretary: to support the project director, marketing engineer and project managers.

The project director (previously a senior faculty member) assumed full time responsibility for the project in May 1996. He and two part-time assistant directors have, with the assistance of an advisory board, developed strategic goals for the program and established operating procedures for accepting project work. A number of methods for handling issues pertaining to intellectual property, confidentiality and fees have been established. The T.E.D. program offers the possibility of for fee and *pro-bono* projects - both of which fall within the purview of the program and meet the needs of industry and our academic programs.

In an area of the country where industry, and particularly high tech industry is not in high concentration, the availability of the marketing engineer to search out prospective clients is invaluable. Many (small) institutions like Rose-Hulman find it virtually impossible to have faculty devote their time to the acquisition of projects. The marketing engineer is an institutional resource that releases faculty to do what they do best, namely educate students. Since hiring the marketing engineer in 1996, over one hundred projects have been identified, completed or are still in progress. Currently two project managers, one each in the areas of applied optics and mechanical engineering, have been retained, and the third (electrical engineering) will be hired before the completion of the C.T.R.I. building in September 1998.

The engineering workspace includes four product/process development (PPD) laboratories and additional general-purpose laboratories, which provide the essential operational facilities for project work. They provide the environment in which teams of faculty members and students from different disciplines will work on the development of products, technologies, or industrial processes. The PPD laboratories each include:

- CAD and computer modeling hardware and software
- database search capability

BEST COPY AVAILABLE

_ general purpose test equipment
_ computer aided presentation equipment
_ access to video conferencing equipment

The last item in the list above will enable faculty/student teams to interact with their industrial clients without the need for travel. To our knowledge, no program focusing on **all** aspects of product/process development now exists in any US educational institution.

The Entrepreneurial Internship Program

There are two components to the internship program. The first component relates to the day-to-day operation of the program that is overseen by an Internship Director. The other provides an endowment to support the operating costs of the internship program – essentially a subsidy provided to support student salaries. Two previous sources of funding have been supporting entrepreneurial internships and these, coupled with the Lilly funds have enabled us to expand the program.

Companies interested in participating in the program communicate that intention to the Internship Director working in the Rose-Hulman Office of Career Services. In a similar manner students seeking entrepreneurial internships apply each year for the limited number of positions. The program has two foci: the first is the actual internship experience coordinated by the Internship Director who matches the student with an appropriate company. She negotiates the terms, which include a financial contribution from Rose-Hulman to support the student's salary and the commitment of the company to provide the appropriate level of mentoring from a senior employee. Due to the nature of entrepreneurial organizations the senior employee is often the chief engineer, but may perhaps be the company vice president or president. The company, for its part, guarantees to expose the student to as many aspects of the organization's business as possible throughout the ten-week internship. In the first year only five students participated. The students provide the company with a very economical source of engineering talent, and they truly immerse themselves in the experience. In addition to their responsibilities to **work** for the company, they are required to read Peter Drucker's text *Innovation & Entrepreneurship*, and produce a comprehensive written review of that text. When they return to college in the Fall they discuss the text (and their internship experience) in an open forum. They also are required to make a long-term commitment to find a way of supporting future Rose-Hulman engineering students interested in entrepreneurship. The arrangement has been very successful; of the five students participating in the first year of the program (1996), four had determined that they would indeed pursue their goal of starting their own company while the fifth actually did so! Sixteen graduates of the class of 1997 who participated in the program secured employment in small entrepreneurial organizations.

Cost/Benefits of the T.E.D. Program

The costs associated with establishing of the program are considerable. Indeed without the support of the Lilly Endowment (T.E.D.) and the Federal Government (C.T.R.I) it would have been impossible for the institution to make it work. Our expectations are that, as the program ramps up, the flow of projects into the program will increase and it will become self-sustaining. Benefits accruing to the institute include, closer ties with local industry, a source of potentially commercially-viable projects, professional development opportunities for the faculty, equipment donations from industry and financial support for the project work component of our undergraduate programs. In the first year of operation (7/96 – 6/97) sixtyfive project leads were identified and in the current year (7/97 – to date) fiftyone projects have been obtained.

Industry benefits through the access to engineering intellectual capital be it faculty or student. For small start-up operations, the availability of faculty may eliminate the need for an R&D department, at least until the company has grown sufficiently to support one. The professional development opportunities for the faculty member are obvious. Working relationships that have already been established have resulted in the donation of equipment and/or commercial product at little or zero cost to the institute. Student projects are undertaken on the understanding that legitimate project costs will be covered by the company, including the cost of travel for students and faculty to company premises (or elsewhere) if required by the client.

Through closer relationships with local business, the faculty is kept informed of current trends as they occur in the workplace, and this in turn may result in curriculum development. The nature of the projects provided by our industrial/business partners vary from the straightforward one-quarter project, through more involved projects suited to year long (senior) projects, to those that are more appropriately handled as a graduate level (thesis) project.

The Future

The real impacts of the T.E.D. program are long-term, hard to measure and subject to variables well beyond Rose-Hulman's control. Every innovation involves risk, and the impacts of this program are sure to be bundled with changes due to economic and social conditions, which are hard to foresee. The effects of project-based education and involvement with Indiana firms are no doubt going to be positive. In compliance with the **process** requirements of ABET (the

BEST COPY AVAILABLE

Accreditation Board for Engineering and Technology) continuous monitoring and assessment of educational outcomes coupled with continuous improvement practices are being established. The project based approach to engineering education signals a move away from the more traditional approach in which students rarely (if ever) interact with practicing engineers on a professional basis.

Overcoming tradition in positive ways will also be needed for success in contributing more to Indiana's economy. For example, it will probably take time to overcome the tradition of leaving for greener pastures after completing college. In fact, many of the Indiana businesses, which are benefiting from this program, may realize those benefits only after graduates have left the state to return later. This tradition is the result of a perception that there is a lack of opportunity in Indiana although a considerable number of high-tech companies are moving or have moved into the state. Indianapolis Mayor Goldsmith has recently established a taskforce to study ways of attracting and retaining high technology companies to what some sources are referring to as the *Silicon Prairie*! The Technology and Entrepreneurial Development Program is helping to show the possibilities, but continued growth of opportunities at competitive salaries will be needed to establish new career patterns. In addition, much larger positive results for retaining college graduates will occur if other institutions emulate the program at Rose-Hulman.

The stimulation of new businesses or expansion of existing ones will only occur if capital and ease of access to markets is present, as well as technological expertise. General economic conditions can affect plans for new or expanding businesses, and the overall economic climate and infrastructure of the state must encourage location here rather than elsewhere in the world. It will also be important that the state have the cultural, educational, and quality of life features that attract and retain educated people, as well as the economic infrastructure and jobs with attractive compensation. At the time of writing the outlook for achieving the objectives of the program looks very good. Rose-Hulman is monitoring its success in achieving its economic targets for the program, identifying the forces facilitating and opposing success, and working with industry and government leaders to maximize the benefits for Indiana's business future.

However, our primary mission is the education of engineers, mathematicians and scientists who are prepared for the twenty-first-century workplace. With this in mind, industry-based project work is becoming a necessary component of our educational programs. We are currently engaged in a very extensive, long-term, restructuring of our curricula and educational environment[6],[7]. One of the possible outcomes of this curricular restructuring process will be the mandatory participation in project work, as a requirement for graduation. In essence, therefore, we will continue to undertake project work because it will have become an integral part of our various curricula by the time the new millennium begins.

References

1) A Proposal to the Lilly Endowment Inc. January 5, 1996. B.J. Farbrother et al.

2) "US Panel warns Colleges to cut costs or risk Erosion of Public Trust". The Chronicle of Higher Education, January 30, 1998. Volume XLIV, number 21, pp A26.

3) "Western Governor's University takes shape as anew model for Higher Education". The Chronicle of Higher Education, February 6, 1998. Volume XLIV, number 22, ppA21.

4) "For profit Higher Education sees Booming Enrollment and Resources". The Chronicle of Higher Education, January 23, 1998. Volume XLIV, number 20, pp A36.

5) "A Hands-on Approach to Engineering is reflected in New Facility in Colorado". The Chronicle of Higher Education, February 20, 1998. Volume XLIV, number 24, ppA29

6) "An Integrated First year Curriculum". A proposal to the National Science Foundation: J.E.Froyd et al. February 1989.

7) The Foundation Coalition. A Proposal to the National Science Foundation: D.R. Richards et al. March 1993.

BEST COPY AVAILABLE